

App. No. 09/773,438

**a.) Specification**

Please amend the paragraph at page 10, ll. 17-20 as follows:

While the present invention has application in a multitude of industries using heat exchange on fluid flows, for illustrative purposes we focus herein on the field of petroleum refining. This focus should not be construed to limit the invention to any specific application. The present invention relates to both the processes and the apparatus' described herein.

Please amend the paragraph at page 12, line 12 through page 13, line 11 as follows:

The present invention addresses the need for efficient, simple apparatus and method for preventing the fouling of heat exchangers. In one aspect of the present invention, an electric charge is applied to a surface of a process element to be kept free of contaminants (i.e., the critical surface), or to a surface of an object near or upstream of the process element. The effect of the electric charge will be to trap contaminants or otherwise keep the process element or the critical parts of the process element free of contaminant. In a specific application, the process is petroleum refining, the process element is a heat exchanger and the potential contaminants are coke, fly ash and catalyst particles. In the process, the fluid stream consists of a hydrocarbon mixture. The critical surface in this specific application is the surface at which heat transfer occurs. The charge is ideally applied to a target surface at or upstream of the heat exchanger, but may be applied downstream of the heat exchanger so long as it is close enough and powerful enough to keep foulants away from the heat exchanger. Measurement of contaminant levels in

App. No. 09/773,438

the vicinity of the heat exchanger is one possible way to determine if the magnitude of the applied charge is sufficient. As contaminant levels increase, an increase in charge is called for. The charge may be attractive or repulsive. This charge is applied through the use of a voltage source electrically coupled (e.g., by a simple wire or other common means) to the target surface with electrically couplable connections and an electrical channel. The attractive or repulsive voltage can be ~~constant~~ direct (DC) or sinusoidal (AC ~~or DC~~). As long as the applied voltage and the resulting charge are of a sufficient magnitude to adequately attract or repel the foulants, it is immaterial whether the voltage is constant or modulated in some way (e.g., sinusoidally modulated). Either embodiment is useful in the present invention.